

Historic, Archive Document

Do not assume content reflects current scientific knowledge, policies, or practices.

H-5-E
Reserve

United States Department of Agriculture

Report to Annual Conference
Cooperative Meat Investigations

August 15-18, 1932
Chicago, Illinois.

(Not for publication)

EXPERIMENTS TO DETERMINE THE EFFECT OF INITIAL SEARING
IN THE ROASTING OF BEEF, LAMB AND PORK

The standard method of roasting beef ribs, leg of lamb, leg and loin of veal and pork for palatability tests includes very high oven temperatures at the start for short, quick searing followed by slow to moderate temperature for the finish of the cooking. Since the directions were issued in 1927-28 several members of the committee on cooking methods questioned the desirability of continuing to sear cuts from experimental animals to be judged for palatability and have requested special discussion at this conference of the advantages and disadvantages of searing as a part of the procedure outlined in the standard method for roasting. For discussion the Department suggested that each member of the committee bring in data on the effect of searing on roasts. Accordingly the three cooperating bureaus of the Department of Agriculture (Bureaus of Home Economics, Animal Industry, and Agricultural Economics) have jointly carried out a series of experiments on beef, lamb, and pork.

Beef

Ten pairs of beef ribs, 9 - 10 - 11, of different carcass grades were roasted to the same rare stage and judged for palatability. The ten left cuts were roasted by the standard method (seared 20 minutes at 265°C., finished at 125°C.), and the corresponding 10 right cuts were roasted at 125°C. constant temperature (without searing). The figures for shrinkage, cooking time, palatability, and resistance to shearing are given in Tables 1 and 2.

Lamb

Six pairs of lamb legs of different grades were roasted to the same medium done stage. The left legs were roasted by the standard method (seared 20 minutes at 265°C., finished at 125°C.) and the corresponding right legs were roasted at 125°C. constant temperature (without searing). The figures for shrinkage, cooking time, palatability, and resistance to shearing are given in Tables 3 and 4.

450 (8/11/32)
L.M.Alexander

Four more pairs of lamb legs were seasoned with salt, pepper, and flour, and cooked in the same way as the six pairs of legs, but they were not tested for palatability in the usual manner. The figures for shrinkage and cooking time of the seasoned lamb showed the same general trend in relation to searing as the lamb cooked by the standard method.

Pork

Ten pairs of center cuts of pork loin were roasted to the same well-done stage. All of these roasts were seasoned with salt, pepper, and flour before cooking. Some of the left cuts and some of the right cuts were seared for 30 minutes at 250°C. and finished at 160°C. The corresponding cuts were roasted at 160°C. constant oven temperature (without searing). Only three of these pairs of roasts were tested for palatability in the usual way.

The standard method of roasting pork loin (20 minutes searing at 255°C. finishing at 150°C.) was not followed in these tests. However, the results are probably indicative of what would have happened if the standard method had been compared with a constant 150°C. The figures for shrinkage, cooking time, palatability, and resistance to shearing are given in Tables 5 and 6.

Summary

In general the data show uniform results as to the effect of searing on appearance, shrinkage, cooking time, and palatability in tests made on beef, lamb and pork. For all of the beef and lamb roasts cooked at constant low temperature without searing, the external fat was either dull or very pale in color. Beef ribs roasted only to the rare stage did not show a striking contrast in the color of the outer surface of the lean meat, as between seared and unseared roasts. However, in most cases the outside lean of unseared roasts was dryer looking and darker in color with less browning. Lamb legs cooked almost to the well-done stage for judging were considerably more attractive in appearance when seared than unseared.

Pork loins were cooked at a higher constant oven temperature than that used for beef and lamb and the pork was roasted well-done. The loins cooked at a constant temperature were acceptably browned in some cases, but in others they were judged to be a little pale in color.

Searing decreased the number of minutes per pound required by the beef, lamb and pork.

The cooking losses of the seared roasts were greater than the unseared. The most striking difference associated with searing was in the relative amounts of fat lost. When the drippings were poured out into graduates and allowed to separate into fat and brown meat juice, the drippings from beef and lamb were almost exclusively fat.

Palatability tests and tests of the resistance to shearing were conducted in the usual way. These tests revealed no consistent or significant differences associated with searing beef ribs, lamb legs, and pork loins, except for the flavor of beef fat. The scores given by the judges indicate a preference for the fat of the seared roasts.

TABLE 1. -- Shrinkage and cooking time of seared and unseared beef ribs
(9 - 10 - 11) of different grades

Method of roasting	Grade of beef	Roast desig- nation	Shrinkage as per cent of weight of uncooked ribs			Time required to roast beef to 58°C	
			Evapo- ration	Drippings	Total	Total minutes	Minutes per lb.
Seared (265°C + 125°C)	choice	1 left	8.3	11.6	19.9	204	16.7
Unseared (Constant 125°C)	choice	1 right	7.4	8.8	16.2	210	19.0
Seared (265°C + 125°C)	choice	2 left	7.8	5.1	12.9	204	19.1
Unseared (Constant 125°C)	choice	2 right	7.0	2.1	9.1	271	22.9
Seared	good	3 left	11.1	10.1	21.1	219	19.0
Unseared		3 right	7.7	5.0	12.6	270	22.0
Seared	good	4 left	7.5	6.1	13.6	183	19.5
Unseared		4 right	5.5	2.2	7.7	216	24.6
Seared	good	5 left	8.8	7.8	16.7	176	21.6
Unseared		5 right	8.6	5.3	13.9	197	22.4
Seared	medium	6 left	9.1	4.5	13.7	199	21.1
Unseared		6 right	6.9	1.8	8.7	185	23.0
Seared	medium	7 left	10.3	3.2	13.5	184	19.6
Unseared		7 right	7.8	2.1	9.9	195	21.9
Seared	medium	8 left	7.9	4.8	12.7	185	20.6
Unseared		8 right	6.8	3.4	10.3	204	22.4
Seared	common	9 left	8.8	2.1	10.9	148	17.6
Unseared		9 right	7.8	1.3	9.0	203	22.5
Seared	common	10 left	8.7	3.8	12.4	146	18.6
Unseared		10 right	6.5	2.2	8.7	191	22.7
Average seared			8.8	5.9	14.7	185	19.3
Average unseared			7.2	3.4	10.6	214	22.3

APR 22 1944

TABLE 2: - Palatability scores and resistance to shearing of seared and unseared beef ribs (9-10-11) of different grades

Method of roasting	Grade of beef	Roast designation	Palatability scores										Resistance to shearing pounds
			Aroma		Texture	Flavor of fat		Flavor of lean		Tenderness	Juiciness		
			Intensity	Desirability		Intensity	Desirability	Intensity	Desirability		Quality	Quantity	
Seared Unseared	choice	1 L 1 R	3.8 3.4	4.4 3.8	4.8 5.0	3.4 3.8	4.4 4.6	4.8 4.8	4.8 5.2	4.8 5.6	4.8 4.6	5.0 5.2	18.5 23.9
Seared Unseared	choice	2 L 2 R	4.6 4.4	5.8 5.6	5.2 5.2	4.0 3.4	6.2 5.0	5.2 5.0	6.2 5.8	5.8 5.8	4.8 5.2	5.6 5.4	25.4 24.3
Seared Unseared	good	3 L 3 R	4.2 4.2	3.6 4.4	4.6 4.3	4.0 3.8	4.8 3.8	4.4 4.6	4.8 4.0	6.0 5.8	4.4 4.0	5.6 5.2	21.1 22.3
Seared Unseared	good	4 L 4 R	5.0 4.6	4.6 5.4	5.4 4.4	4.0 4.2	5.4 4.8	4.6 4.8	5.4 5.4	4.8 5.6	4.8 4.8	5.2 5.8	34.6 32.9
Seared Unseared	good	5 L 5 R	5.2 4.8	4.8 5.2	5.4 5.4	4.6 4.4	5.2 5.2	4.4 5.0	5.4 5.6	5.6 5.6	4.8 5.2	5.2 5.4	29.1 26.6
Seared Unseared	medium	6 L 6 R	4.2 4.2	4.8 4.4	5.6 5.6	3.8 4.0	4.6 4.2	4.2 4.4	5.0 5.4	5.4 5.6	4.4 4.8	4.6 5.2	24.9 27.3
Seared Unseared	medium	7 L 7 R	4.2 4.0	3.8 4.8	4.4 5.0	3.4 3.0	4.4 3.8	4.6 4.4	5.0 5.2	5.8 5.2	4.8 4.4	4.6 4.6	25.9 27.8
Seared Unseared	medium	8 L 8 R	4.6 5.6	5.0 4.8	4.8 4.6	3.8 3.8	5.4 5.0	4.8 5.0	5.4 5.4	5.0 5.0	4.4 4.6	5.4 5.2	33.0 32.4
Seared Unseared	common	9 L 9 R	4.0 4.4	4.4 4.4	4.6 4.8	3.8 3.4	3.8 3.2	4.0 4.6	4.4 4.4	4.8 4.8	3.6 4.0	4.6 5.0	28.1 23.8
Seared Unseared	common	10 L 10 R	5.0 4.6	5.0 4.8	4.2 4.8	3.8 4.0	5.0 4.8	4.4 4.4	5.0 5.2	5.2 4.6	4.6 4.2	5.4 5.0	23.1 25.6
Average seared			4.5	4.6	4.8	3.9	4.9	4.5	5.1	5.3	4.5	5.1	26.4
Average unseared			4.4	4.8	4.9	3.8	4.4	4.7	5.2	5.4	4.6	5.2	26.7

TABLE 3. -- Shrinkage and cooking time of seared and unseared lamb legs of different grades

Method of roasting	Grade of lamb	Roast designation	Shrinkage as per cent of weight of uncooked leg			Time required to roast lamb to 76°C	
			Evapo-ration	Drippings	Total	Total minutes	Minutes per lb.
Seared (265°C + 125°C)	(high)	1 left	12.2	5.4	17.6	206	38.6
Unseared (Constant 125°C)	(good)	1 right	8.0	2.7	10.6	215	40.0
Seared (265°C + 125°C)	(high)	2 left	11.0	2.8	13.8	164	43.9
Unseared (Constant 125°C)	(good)	2 right	7.6	2.1	9.7	183	45.6
Seared	(high)	3 left	11.8	6.2	18.0	170	35.9
Unseared	(good)	3 right	7.6	3.2	10.8	178	38.0
Seared	(low)	4 left	8.2	3.9	12.1	140	33.5
Unseared	(good)	4 right	7.1	2.1	9.2	176	43.7
Seared	(low)	5 left	10.3	3.7	14.0	155	34.8
Unseared	(good)	5 right	9.1	3.0	12.1	225	48.1
Seared	(low)	6 left	10.8	4.8	15.6	161	40.5
Unseared	(good)	6 right	8.9	3.5	12.4	165	41.1
Average seared			10.7	4.5	15.2	166	37.9
Average unseared			8.1	2.8	10.8	190	42.8

TABLE 4. -- Palatability scores and resistance to shearing of seared and unseared lamb legs of different grades

Method of roasting	Grade of design	Roast nation	Palatability scores										Resistance to shearing, pounds	
			Aroma		Texture		Flavor of fat		Flavor of lean		Tender-ness	Juiciness		
			Inten-sity	Desir-ability	Inten-sity	Desir-ability	Inten-sity	Desir-ability	Inten-sity	Desir-ability		Quantity		Quantity
Seared	(high	1 L	5.2	4.8	4.6	4.0	5.0	4.8	5.4	5.8	4.4	4.8	16.9	
Unseared	(good	1 R	5.0	4.6	4.6	4.4	5.4	4.8	5.0	5.4	4.5	5.3	26.5	
Seared	(high	2 L	5.4	5.4	4.6	4.2	4.8	4.8	4.8	4.6	4.4	5.8	20.8	
Unseared	(good	2 R	5.6	3.0	4.0	4.4	3.8	5.0	4.2	4.4	4.2	4.8	35.3	
Seared	(high	3 L	5.2	5.0	4.2	4.2	5.0	5.2	5.2	5.8	4.4	4.8	17.6	
Unseared	(good	3 R	5.0	6.2	5.0	4.6	5.4	4.6	5.8	5.6	4.6	4.4	18.6	
Seared	(low	4 L	5.4	4.6	4.6	4.2	4.4	5.2	4.8	4.4	3.8	3.8	27.9	
Unseared	(good	4 R	5.2	4.2	4.6	4.0	4.2	5.0	4.2	4.6	3.6	4.0	23.8	
Seared	(low	5 L	4.8	6.0	4.8	4.4	5.0	5.6	5.8	4.8	4.6	4.6	24.5	
Unseared	(good	5 R	5.4	5.8	5.4	4.2	5.6	5.2	5.8	5.2	4.8	4.8	23.5	
Seared	(low	6 L	5.4	5.0	4.4	5.0	4.6	5.2	5.2	5.0	4.8	4.0	28.4	
Unseared	(good	6 R	5.4	4.8	4.6	4.8	4.0	5.0	5.4	5.8	4.2	4.2	19.0	
Average seared			5.2	5.1	4.5	4.3	4.8	5.1	5.2	5.1	4.4	4.6	22.7	
Average unseared			5.3	4.8	4.7	4.4	4.7	4.9	5.1	5.2	4.3	4.6	24.5	

TABLE 5. -- Shrinkage and cooking time of seared and unseared pork loins

Method of roasting	Roast designation	Shrinkage as per cent of weight of uncooked loin			Time required to roast pork to 84°C	
		Evaporation	Drippings	Total	Total minutes	Minutes per lb.
Seared (250°C + 160°C)	1 right	17.1	6.4	23.6	127	31.2
Unseared (Constant 160°C)	1 left	15.6	6.7	22.3	159	35.2
Seared (250°C + 160°C)	2 right	13.9	12.1	26.0	103	29.1
Unseared (Constant 160°C)	2 left	12.9	8.6	21.4	120	33.0
Seared	3 left	17.8	8.6	26.5-	145	29.9
Unseared	3 right	14.8	4.6	19.4	136	33.8
Seared	4 left	15.9	8.5	24.4	98	24.6
Unseared	4 right	13.8	8.5	22.3	123	34.3
Seared	5 left	14.3	10.5	24.8	135	28.6
Unseared	5 right	11.0	9.7	20.7	144	33.3
Seared	6 right	12.0	14.0	26.1	133	24.3
Unseared	6 left	17.4	8.8	26.2	203	37.2
Seared	7 left	15.2	9.3	24.6	176	32.7
Unseared	7 right	14.9	7.2	22.4	191	35.3
Seared	8 right	14.9	11.2	26.1	136	32.0
Unseared	8 left	12.6	9.7	22.3	157	32.8
Seared	9 left	14.7	10.8	25.5	126	25.3
Unseared	9 right	11.1	11.5	22.5	151	28.2
Seared	10 right	14.0	14.8	28.8	140	30.7
Unseared	10 left	14.0	9.8	23.7	175	36.9
Average seared		15.0	10.6	25.6	132	28.8
Average unseared		13.8	8.5	22.3	156	34.0

TABLE 6. -- Palatability scores and resistance to shearing of seared and unseared pork loins

Method of roasting	Roast designation	Palatability scores										Resistance to shearing pounds
		Aroma		Texture	Flavor of fat		Flavor of lean		Tender-ness	Juiciness		
		Inten-sity	Desir-ability		Inten-sity	Desir-ability	Inten-sity	Desir-ability		Quantity		
Seared	5 left	4.2	5.8	5.2	3.6	5.4	4.8	5.6	5.4	5.0	4.6	17.1
Unseared	5 right	4.4	5.6	5.4	3.8	4.6	4.8	5.2	5.2	4.6	4.4	16.1
Seared	7 left	4.0	5.8	5.2	3.0	5.2	4.2	5.6	5.0	4.2	5.0	20.0
Unseared	7 right	4.6	5.8	5.4	3.6	5.4	4.6	6.0	5.6	4.6	5.0	16.4
Seared	10 right	4.4	5.4	4.8	3.8	5.8	4.8	5.6	5.6	4.8	4.6	15.8
Unseared	10 left	4.4	5.6	5.0	3.6	5.6	4.8	5.6	5.6	4.8	5.2	18.3
Average seared		4.2	5.7	5.1	3.5	5.5	4.6	5.6	5.3	4.7	4.7	17.6
Average unseared		4.5	5.7	5.3	3.7	5.2	4.7	5.6	5.5	4.7	4.9	16.9